Sustainable Energy Watch
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Energy and Sustainable Development in the United States of America

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Summary of Report

In recent years the US has not been actively engaging on sustainability issues at the national level. However strictly focusing on national level policy obscures significant energy-related advances made by individual states. State and local clean energy initiatives are creative, growing in size and spreading.

Preface

This report was prepared through a literature search involving published and web material and data. Government information sources such as the EIA's online databases were used extensively, along with published research compilations and summary documents. Most of the information needed for the indicators was readily available. It was not possible to obtain complete information on financial incentives for renewables and data for the other indicators were available for differing years. The "current" year used is the most recent year for which data could be found (ranging from 2002-2004). Where published reports provided conflicting results, an effort was made to present the range of estimates.

All indicators are variants of the form I = (X – Y) / (W – Y), where:

X = the value (in absolute terms) of the parameter for the current year and for 1990.

Y = the sustainability objective (in absolute terms), corresponding to a vector value of 0, the value indicating sustainability.

W = the value (in absolute terms) corresponding to a vector value of 1, the value indicating 'unsustainability'.

Author

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Executive Summary

The USA in recent years has not been actively engaging on sustainability issues at a national level. This is reflected in the HELIO International sustainability indicators. Most significantly, indicator #1, per capita carbon emissions, has continued to increase from 1990 and, in both the base and current year, is far above what HELIO International considers globally sustainable. Along the same lines, US dependence on foreign fossil fuels (indicator #5) has increased from 17.9% to 30.4% from 1990 to 2004, and the proportion of US energy supplied by renewable energy has decreased from 7.2% in 1990 to 6.1% in 2004. This latter figure obscures the fact that renewable energy production has increased, only less so than total energy consumption. The difference is made up by increased use of fossil fuels so the percent of renewables has declined. Federal Investment in clean energy (indicator #4) has also declined, as has public sector investment in nonrenewable energy (indicator #6).

The USA does have some areas of positive sustainability and improvement. As with most OECD countries, the USA has virtually 100% access to electricity (Indicator #3) and electrical prices have historically been low. The US has made significant strides at reducing energy sector air emissions (indicator #2), primarily through the implementation and updating of the Clean Air Act of 1970. US energy productivity continues to improve, but efficiency increases have been eclipsed by increased consumption.

Table 1: Sustainable Development Indicators for the USA Energy Star

Description of Indicator Name	Unit	Current year	Data Points		Star values	
			X(current)	**X(1990)**	**I(current)**	**I(1990)**
1) CO2 emissions	kgC/cap	2003	5,442	5,468	6.460	6.383
2) Ambient pollutants	thousand short tons	2002	n/a	n/a	0.680	1.000
3) Access to electricity	%	2004	100.0	100.0	0.000	0.000
4) Investments	%	1999	6.3	6.9	0.607	1.000
5) Vulnerability	%	2004	30.4	17.9	0.302	0.179
6) Public sector investment	%	1992,99	0.04	0.06	0.058	0.053
7) Energy productivity	MJ/$	2004	8.1	10.4	0.662	0.881
8) Renewable energy	%	2004	6.1	7.2	1.029	1.016

It must be noted that strictly applying the HELIO focus on national level policy and actions obscures significant energy-related advances made by individual states. As a federal republic the USA allows states a large amount of self-governance and autonomy. Following this tradition, state and local level clean energy initiatives are creative, growing in size, and spreading.

Some of these state level initiatives are described more extensively in the report.

Geographic and Economic Setting

The USA is the world's third-largest country by size (after Russia and Canada) and by population (after China and India). The US is about half the size of Russia, slightly larger than China and almost two and a half times the size of the European Union. 19.13% of the land is arable, with 214,000 sq km (2.3%) of irrigated land (1998 est.) and 20,156 sq km (0.22%) planted in permanent crop.

Table 2: Country Data (2005 unless otherwise noted)

Land area	9,631,418 sq km, including 469,495 sq km of inland water
Borders	Canada: 8,893 km, Mexico: 3,141 km
Population	295,734,134
Population growth rate	0.92%
Net migration rate	3.31 migrant(s)/1,000 population
Life expectancy	77.7 years
Literacy rate	97%
Labor force & breakdown	147.4 million (including unemployed): farming, forestry, and fishing 0.7%, manufacturing, extraction, transportation, and crafts 22.7%, managerial, professional, and technical 34.9%, sales and office 25.5%, other services 16.3%.
Unemployment rate	5.1% (2005)
Pop. below poverty line	12% (2004)

The USA has a real GDP growth rate of 3.5%, the public debt is 65% of GDP, and the external debt is $8.8 trillion. The US has a substantial trade deficit, with imports at $1,727 billion and exports at $795 billion. Its primary trade partners are Canada, China, Mexico, Japan, Germany, and the UK. Crude oil was 8.2% of total imports in 2003. Unless otherwise noted, all statistics above are 2005 estimates from the Central Intelligence Agency (2006).

The USA has the basic rights, education, standard of living and income expected in a developed nation, but does not garner top rank on the Human Development Index or the Sustainability Index (Table 2). There is no national health care, and the last few years have seen a skyrocketing public debt and deficit, increased political polarization, corporate and public scandals and public tragedies such as 9/11 and Hurricane Katrina.

Table 3: National Performance Indicators

Indicator	Value
2003 Human Development Index (and ranking) (UNDP, 2005)	0.944 (#10)
2003 Human Poverty Index (and ranking) (UNDP, 2005)	15.4 (#17)
Environmental Sustainability Index (Yale, 2005)	52.9 (#17 for OECD rank, #45 for all countries)
GDP and GDP per capita (Central Intelligence Agency, 2005)	GDP: $11.75 trillion (2004 est.) GDP per capita: $40,100 (2004 est.)

Domestic environmental pressures include climate change, sprawl, environmental justice issues, air pollution resulting in acid rain in both the US and Canada, water pollution from runoff of pesticides and fertilizers; limited natural fresh water resources in much of the western part of the country, desertification, and loss of arable land and habitat to urban and rural sprawl. The USA’s total Greenhouse Gas Emissions (GHG) in 2003 were 7,122 million metric tons CO2-equivilant for all emissions sources excluding forests and sinks, representing a 15.8% increase 1990-2003 (EIA 2005).

Overview of National Sustainable Development Strategy

In response to Agenda 21, the 1992 UNCED program for action, the US did develop recommendations for a national sustainable development strategy. From 1993 to 1999 the President's Council for Sustainable Development worked on this issue, publishing two reports (President's Council on Sustainable Development 1996; President's Council on Sustainable Development 1999) then ceasing operations after delivering its recommendations. Operating separately, the US delegation to the Commission on Sustainable Development has reported on progress (United Nations, 2002). There has not been further strategy work at a national level.

The national strategy was ambitious and visionary. The primary focuses of the report were climate change, environmental management, sustainable community development, and international leadership. Energy policy thus played a major part. The strategy report highlighted cross-linkages, stressing the importance of designing policies to solve multiple problems at once, and recognizing that strategies were needed on the multiple fronts of community, economy, health & technology to create vital synergies. The greatest weakness of this strategy has been lack of implementation. There are no established targets or timelines and no domestic policy framework.

Figure 1: National Strategy Goals& Vision:

- Healthy Environment
- Economic Prosperity
- Equity
- Conservation of Nature
- Stewardship
- Sustainable Communities
- Civic Engagement
- Population Stabilization
- International Responsibility
- Education

Our vision is of a life-sustaining Earth. We are committed to the achievement of a dignified, peaceful, and equitable existence. A sustainable United States will have a growing economy that provides equitable opportunities for satisfying livelihoods and a safe, healthy, high quality of life for current and future generations. Our nation will protect its environment, its natural resource base, and the functions and viability of natural systems on which all life depends.

The President's Council on Sustainable Development

Some states (NJ, OR, MN) and local communities have taken up the work. In contrast to the national effort, these have shown to be both ambitious and practical, with inclusion of annual indicators, and involvement of interagency and inter-sector working groups. Oregon's Environmental Stewardship Plan proposal, New Jersey's Sustainable State Project, and Minnesota's Sustainable Development Initiative are at the forefront of state-level initiatives.

These state level initiatives are moving sustainability forward despite the lack of a national initiative and provide a base of material by presenting and testing activities that could be used to renew the national effort at a more advanced level.

US Energy Policy and Other Energy-Related Developments

National USA Energy Policy

The US approach to energy policy has varied substantially over the long term. As described by Bamberger (2004), the US focuses on energy policy during times of major price spikes, but efforts wane during relatively stable low-price periods. In the past 35 years US energy prices have been marked by a number of major price spikes and one sudden drop: 1973 (Arab oil embargo), 1979 (fall of Shah of Iran), 1985 (prices plummeted, from OPEC supply increase), 1990 (Iraq's invasion of Kuwait), 1999 (following OPEC production cut, then refining cuts), and more recently due to Hurricane Katrina and increasing oil imports by China.

After the 1973 embargo federal price controls were imposed to keep domestic production prices low. This had the effect of discouraging domestic production. Since the Energy Policy and Conservation Act of 1975 the US has taken a more market-based approach, first deregulating oil prices and later electrical and other energy companies. Prolonged high prices in the late 70s and early 80s encouraged efficiency, conservation, and new production outside of OPEC. OPEC increased production which led to a decline in both prices and US efficiency efforts. This, combined with strong economic growth in the 1990s has resulted in a country that is now more dependent than ever on foreign fossil resources.

Today energy security is a significant concern around the country with widely disparate suggestions for how to deal with the problem. Three current controversial debates within the US are (1) the opening of new federal lands to oil exploration and production– specifically the Arctic National Wildlife Refuge (ANWR), (2) whether companies that used methyl tertiary butyl ether (MTBE) as a gasoline oxygenate should be exempt from liability for MTBE contaminated groundwater given that its use was a government mandated requirement, and (3) the extent to which the US should support and subsidize Generation-IV nuclear plants.

There are currently over 150 energy-related program activities and 11 tax-preferences involving at least 18 federal agencies (GAO 2005). Combined, these programs address eight major energy areas: (1) energy supply, (2) energy's impact on the environment and health, (3) low-income energy consumer assistance, (4) basic energy science research, (5) energy delivery infrastructure, (6) energy conservation, (7) energy assurance and physical security, and (8) energy market competition and education (Table 4).

Table 4: Estimated Budget Authority for Energy Activity Area, Fiscal Years 2000 and 2003 (GAO 2005)

Dollars in thousands

	Estimated budget authority	
Energy activity area	Fiscal year 2000	Fiscal year 2003
Energy supply	$1,591,377	$2,391,566
Energy's impact on the environment and health	1,658,668	1,865,793
Low-income energy consumer assistance	1,979,350	2,211,837
Basic energy science research	874,369	1,165,126
Energy delivery infrastructure	136,835	763,175
Energy conservation	724,087	787,935
Energy assurance and physical security	160,500	247,999
Energy market competition and education	219,101	166,103
Total[a]	**$7,344,287**	**$9,599,533**

Source: GAO analysis of agency estimates.

Over the years the USA has focused much more on securing energy supply than on securing energy services through other means (such as efficiency). Arguments by Rocky Mountain Institute and others that radical efficiency using 'nega-watts' rather than 'mega-watts' makes better economic sense are gaining acceptance, but have yet to be acted on at a national scale. The strong focus on securing supply continues today.

The Bush administration's National Energy Policy signed into law in 2005 includes targets for reducing the carbon intensity of the US economy by 17 percent below business-as-usual by 2008-2012, but does not include targets for achieving absolute emission reductions. The Act includes a wide array of studies and programs for both fossil fuels and alternatives including a requirement for the federal government to purchase 7.5% of electricity from renewables by 2011, extension through 2025 of the Price-Anderson Act liability cap for nuclear power facilities, and an extension through 2014 of a means for automakers to meet fuel economy standards by production of vehicles that are able to run on both standard and alternative fuels. The Act also includes a $14.5 billion tax package of which renewable energy and energy efficiency received $4.5 billion, fossil fuels received $5.6 billion, and nuclear power received $1.3 billion (UCS, 2005). The act does not include the national "renewable portfolio standard," advocated by renewable energy supporters which would have required that a certain percentage of electricity generation come from non-hydro renewable energy sources.

Table 5: Past Major Energy Legislation

Date	Title	Description
1935	Public Utility Holding Company Act of 1935 (PUHCA)	Enacted to break up trusts that controlled electric & gas distribution network
1936	Rural Electrification Act	Established Rural Electrification Administration
1954	Atomic Energy Act	Encourage development of nuclear energy for peaceful purposes.
1975	Energy Policy and Conservation Act	Established national appliance efficiency standards, also phased deregulation of oil prices. Established Corporate Average Fuel Economy (CAFE) standard for production of more fuel-efficient passenger cars (DOT-administered). Originally required CAFE to be raised from 18.0 mpg in 1978 to 27.5 in 1985. Current standard is 27.5 mpg for cars, 21.6 mpg for light-duty trucks & SUVs
1978	National Energy Act (5 major statutes in response to Embargo, including PURPA, ETA)	(PURPA) Promote electric energy conservation, required utilities to purchase power "feed-in" from small producers, but implementation discontinued in 1990s. (ETA) encouraged renewables including tax credits, but incentives curtailed in mid 1980s through tax reform legislation.
1970 /1990	Clean Air Act Amendments of 1990	Established new emissions-reduction program (for SO2, NOx using market-based trading system for SO2.
1992	Energy Policy Act (EPACT)	Opened up electricity supply to wholesale non-utility generators, authorized more recent energy efficiency standards and programs to promote efficient and renewable energy.

State Energy Policies and Actions

The lack of national agreement on energy policy has instigated states to take the lead in developing and adopting numerous and varied strategies for energy efficiency and renewable energy. These are further described in the appendix and in indicators 4 and 8.

Most states have some form of renewable energy incentives, and 18 states have adopted renewable energy portfolio standards requiring a certain proportion of electrical power to be produced by renewables. A number of states are also creating state-level sustainable strategies and developing the means to implement them. State action can lead to a national response as indicated by the fact that 35 states had adopted Net-metering requirements before a 2005 law was enacted nationally requiring all US utilities to provide net metering within 3 years. Net metering provides an incentive for grid-interconnected photovoltaic (or solar electric) systems.

Non-Governmental Organizations and Coalitions

There are numerous organizations and coalitions in the USA involved in energy policy and associated efforts. These range from traditional advocacy organizations like the NRDC, Sierra Club, Environmental Defense, and the Worldwatch Institute, to nonpartisan think tanks and consulting organizations like Rocky Mountain Institute, Union of Concerned Scientists, and Tellus, to coalitions such as the Apollo Alliance, and the National Commission on Energy Policy.

These organizations have played a major role in creating and advocating for strong and practical energy policy plans – and in implementing positive energy strategies wherever there is an opportunity to do so.

In the USA, where many still believe that it is "jobs vs. environment", efforts to reframe the debate are particularly important. The Apollo Alliance emerged in 2003 to do just that with the tag line "Three Million New Jobs, Freedom from Foreign Oil". With a name harking back to the successful US effort to put a man on the moon, the Apollo Alliance is framing the energy issue as an opportunity for a technological playground akin to the computer or aircraft and aerospace industries, requiring major public investment and support and reaping major and potentially unexpected rewards.

Environmental Sustainability

Indicator 1: Per Capita Carbon Emissions from the Energy Sector

The US is the largest single emitter of carbon dioxide from the burning of fossil fuels with per-capita carbon emissions at 5,375 kg C/capita in 1990 and 5,536 kg C/capita in 2004 (EIAc., 2005). This is far above the level of 339 kg C per capita or 3/10 the world's average for 1990, which is deemed sustainable by HELIO International. While total carbon emissions continue to increase (Fig 2a), per capita emissions appear to be relatively stable, if higher than the rest of the world (Fig 2b), and carbon intensity (carbon emissions per unit of GDP) has significantly declined (Fig 2c). In the US, as in China, increases in GDP continue to outstrip carbon intensity improvements and total emissions continue to climb. These mixed trends show that a focus only on reducing carbon intensity (per US national policy targets) may not lead to absolute reductions in the presence of continued high total and per capita GDP growth.

Figure 2a: Total Carbon Emissions (EIAc, 2005)

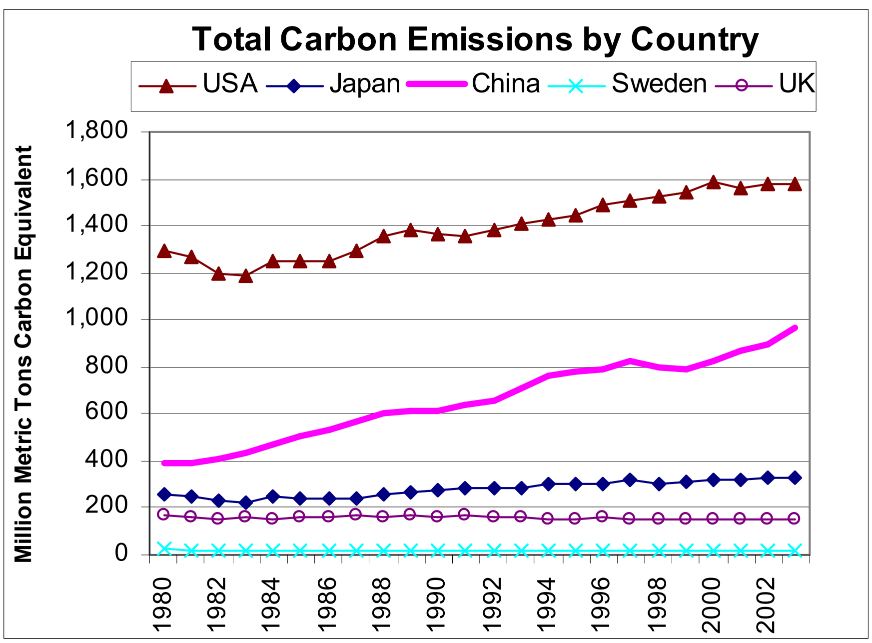


Figure 2b: Per Capita Carbon Emissions (EIAc, 2005)

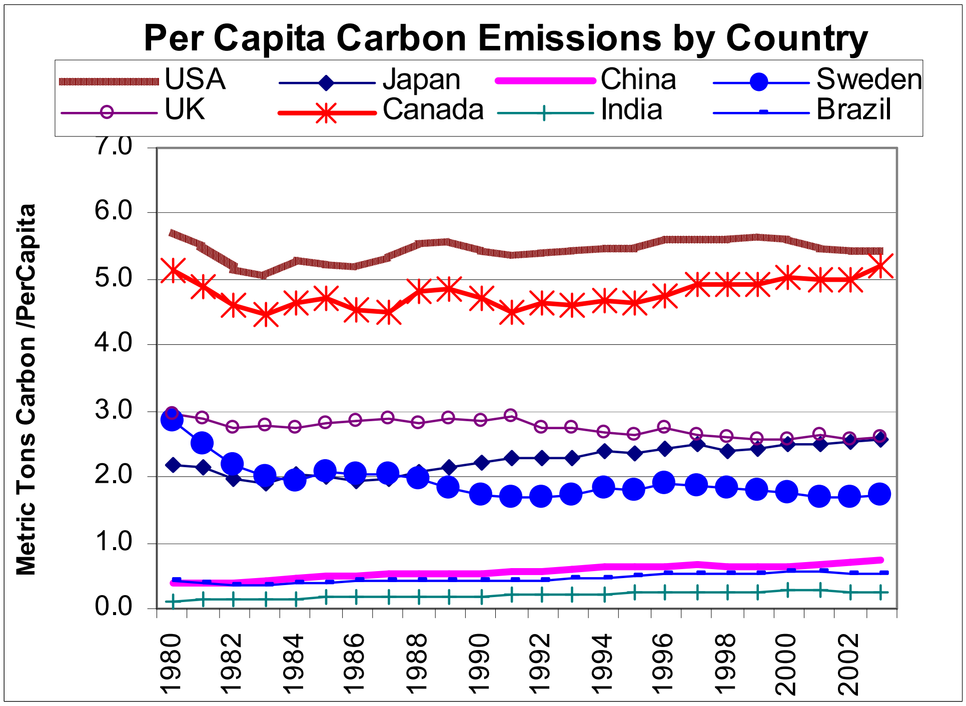


Figure 2c: Carbon Intensity by Country including China (EIAc, 2005)

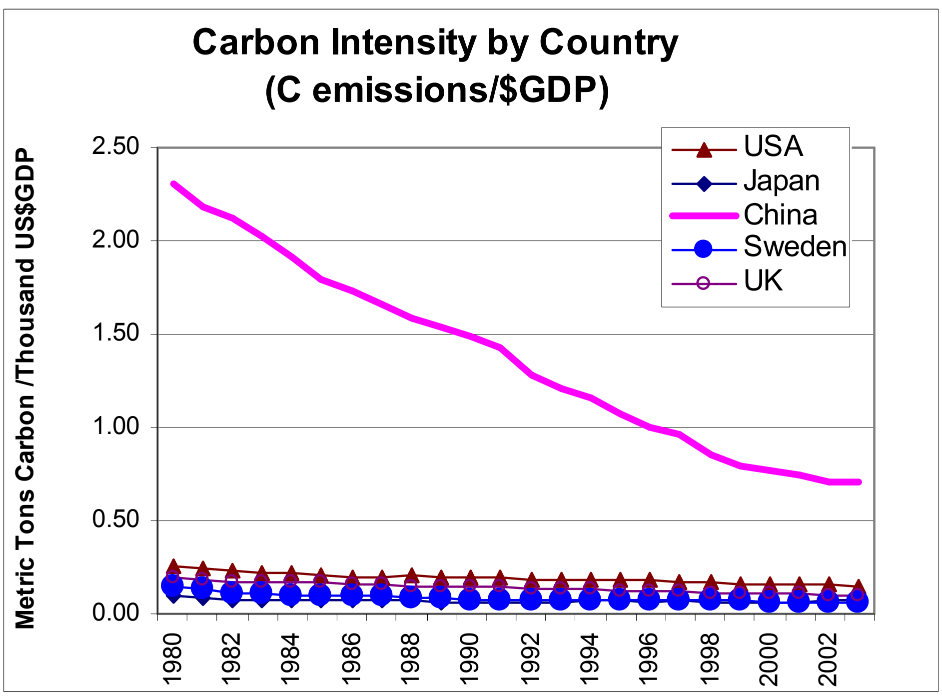
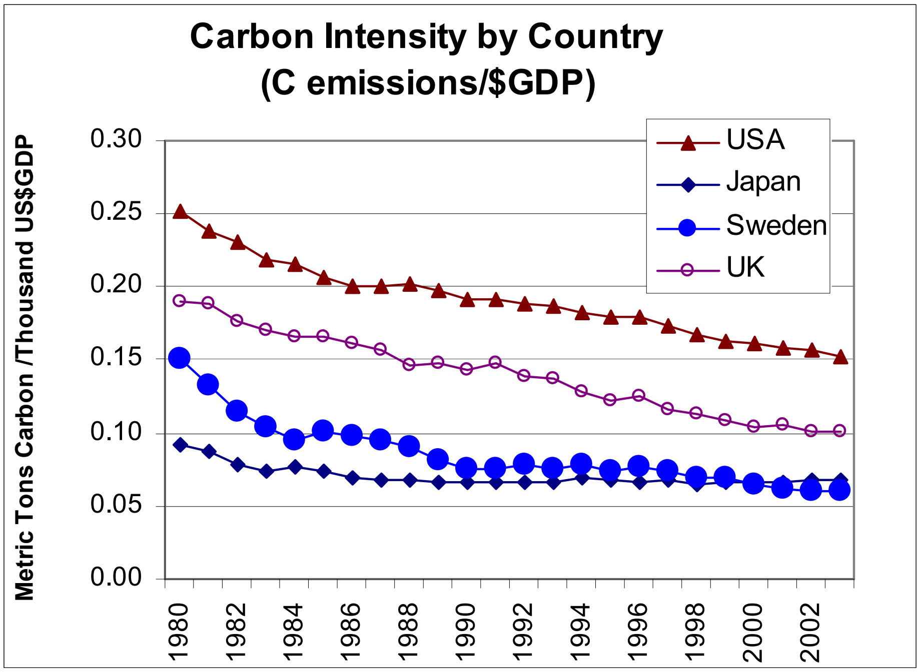


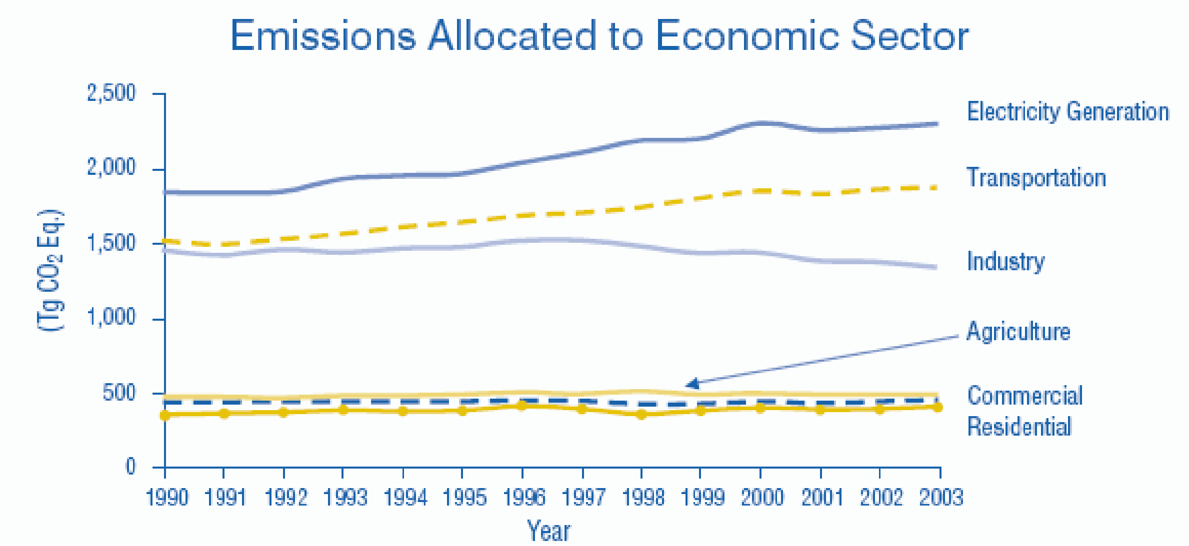
Figure 2d: Carbon Intensity by Country Excluding China (EIAc, 2005)



The HELIO measure calculates CO2 emissions. While CO2 represents over 80% of GHG emissions (EPAb., 2005), other gases have a much higher 'global warming potential' (GWP anywhere from 23 to almost 24,000 times that of CO2). The US EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks (EPA, 2005b) provides a historical account of anthropogenic GHG sources and sinks normalized by CO2 to give the total GWP of net emissions. It covers CO2, Methane, Nitrous Oxide (N2), HFCs, PFCs, and SF6. HFCs, PFCs & SF6 account for a minor fraction of the total annual emissions (In 2003 equal to 2% of total emissions normalized by GWP). However some of them have extremely long atmospheric lifetimes and their combined emissions have increased 50% since 1990, making their accumulation a significant concern.

It is also useful to note the differences by economic sector (Fig 4). Note that the decline in industrial emissions may not be due to increased efficiency but rather reduced manufacturing in US. Similarly, the improvement in US energy intensity may be somewhat due to the movement of high carbon-intensity industries to less developed nations. The effect of efficiency will be discussed further in indicator 7.

Figure 3: US GHG Emissions by Economic Sector (EPA a., 2005)



Calculation of Indicator 1 vector value (USA emissions of Carbon per capita)
Values:

X (1990) = 5,375 kgC/capita (EIA, 2005)
X (2002) = 5,536 kgC/capita (EIA, 2005)

	1990	2004
Energy-related CO2 emissions, million metric tons (EIA 2005)	4914	5868
Population	248,709,873	293,655,404

Conversions: 0.2727 C/CO2, 1000kg/metric ton

X (1990) = 4914 million MT CO2 x 100kg/metric ton x 0.2727 C/CO2 /248,709,873 X (1990) = 5,388 kgC/capita

X (2002) = 5868 million MT CO2 x 100kg/metric ton x 0.2727 C/CO2 /293,655,404 X (2002) = 5,449 kgC/capita

W (Unsustainable, 1) = 1130 kgC/capita (world average for 1990)

Y (Sustainable, 0) = 339 kgC/capita (3/10 the world's average for 1990)

EIA Table 5. US Carbon Dioxide Emissions from Energy and Industry, 1990 and 1995-2004

Vector Value:
I(1990) = (5,388 – 339) / (1130-339) = 6,383
I(1990) = (5,449 – 339) / (1130-339) = 6.460
Note that a vector value of zero is considered to be sustainable and a vector value of one or greater is unsustainable.

Indicator 2: Most Significant Energy-Related Local Pollutants

The US has made significant strides in reducing air pollution (Figure 4), mainly through the Clean Air Act of 1970 and its amendments. The CAA required that air quality standards be established for pollutants that have adverse effects on public health or welfare, termed "criteria pollutants" because the EPA based ambient air quality standards on health based criteria from scientific studies. The Clean Air Act was amended in 1990 to limit emissions of SO2 and NOx, and the EPA revised air quality standards again in 1997 to include PM2.5 (particulate matter smaller than 2.5 microns).

The energy sector pollutants reported in this indicator include CO, NOX, SO2, and energy-related VOCs. The energy sector is the dominant source of emissions for these pollutants (89%, 96%, 94% and 58% respectively in 1990), and they are all monitored by the EPA (thus accurate data is available) (EPAc., 2005). According to the guidelines for the HELIO International report, data for the four pollutants are collected and then combined to create a single vector. For VOCs, non-energy-related emissions were excluded from the indicator calculation.

Major energy sector pollutants that are not included in the indicator are heavy metal pollutants (lead, mercury, chromium), particulates (PM2.5 and PM10), and smog consisting of ground level ozone. Particulates are a significant and difficult problem but are not included in the indicator because the energy-related proportion of emissions is only 21% for PM2.5 and 7% for PM10. Ground level ozone is formed from NOx and VOCs through a complex nonlinear process, thus simply reducing the constituents will not necessarily decrease ozone formation.

The US has seen considerable success with market-based emission controls. The US SO2 trading system is an international model for emissions trading: It set caps for 10 million tonnes below 1980 level, and allowances can be bought, sold, traded, or “banked” and stored for future years. The price is much lower than anticipated because the use of low-sulfur coal reduced the need for expensive scrubbing systems while at the same time the price of scrubbing systems declined. The CAA also caps NOx, and regional trading systems have developed. In contrast to SO2, prices for traded NOx have been unstable. (Burtraw, 2005 and Stavins, 2005) A federal NOx trading program has been established as a model for use by states, but has not been taken up.

Figure 4: Energy-related Emissions (EPA c., 2005)

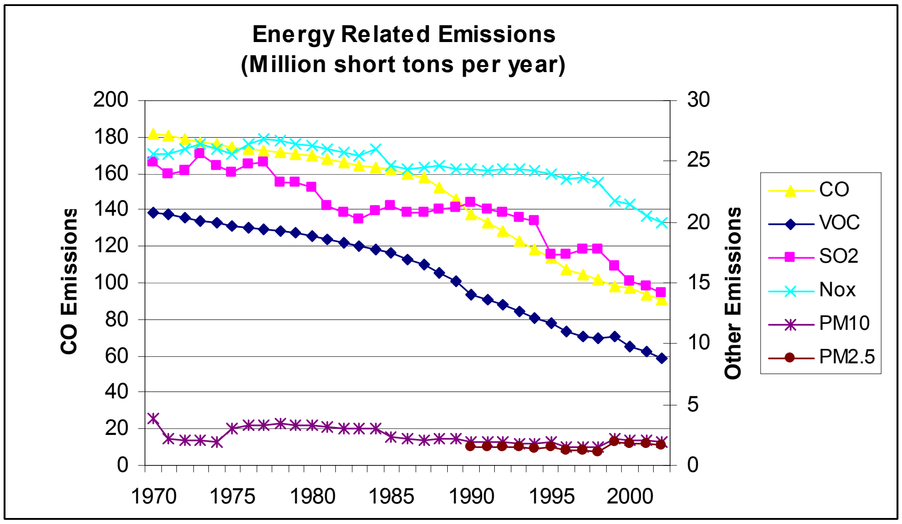


Table 6: Calculation of Indicator 2 Vector Value (EPA c., 2005)

	Data Points (thousand short tons)		**Parameters**			**Results**	
	X(2002)	X(1990)	W(reference)	Y(goal)	Z	I(2002)	I(1990)
2a) VOCs*	8,781	13,969	13,969	1,397	12572	0.587	1.000
2b) SO2	15,353	23,076	23,076	2,308	20768	0.628	1.000
2c) Nox	21,102	25,529	25,529	2,553	22976	0.807	1.000
2d) CO	112,049	154,186	154,186	15,419	138767	0.696	1.000
vector value						0.680	1.000

*VOCs energy related only

Equation: $I = (X - Y) / (W - Y) = (X-Y)/Z$
Note that a vector value of zero is considered to be sustainable and a vector value of one unsustainable. The value for Y, the sustainability "goal", is 90% reduction from 1990 levels.

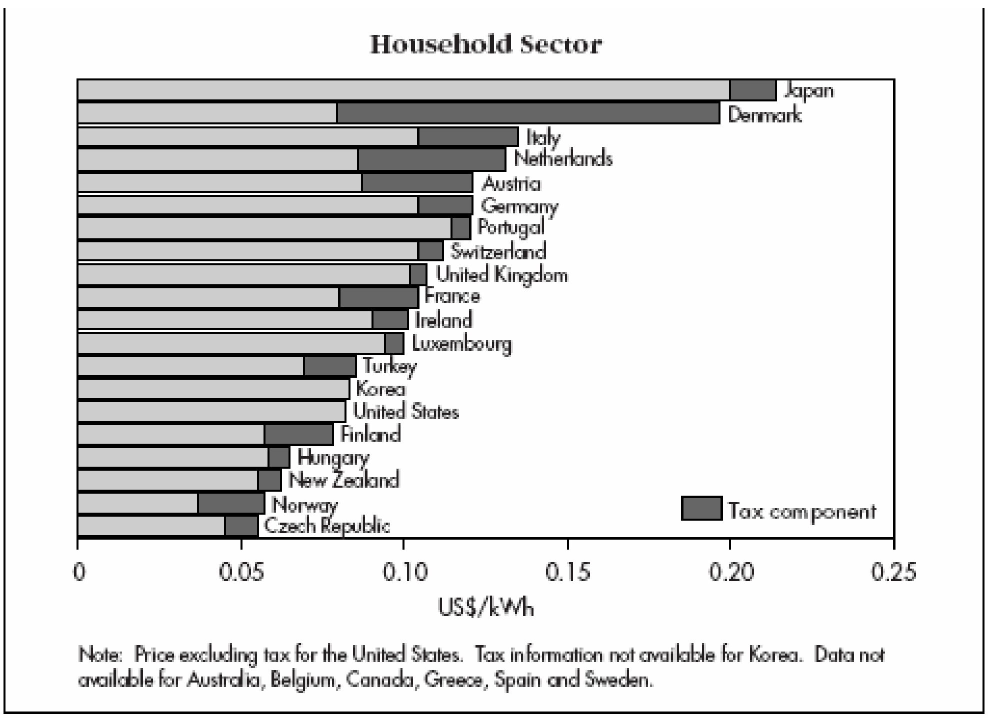
Vector Value:
The vector for indicator 2 is simply an average of the indicator value I for 2a through 2d.

Social Sustainability

Indicator 3: Households with Access to Electricity

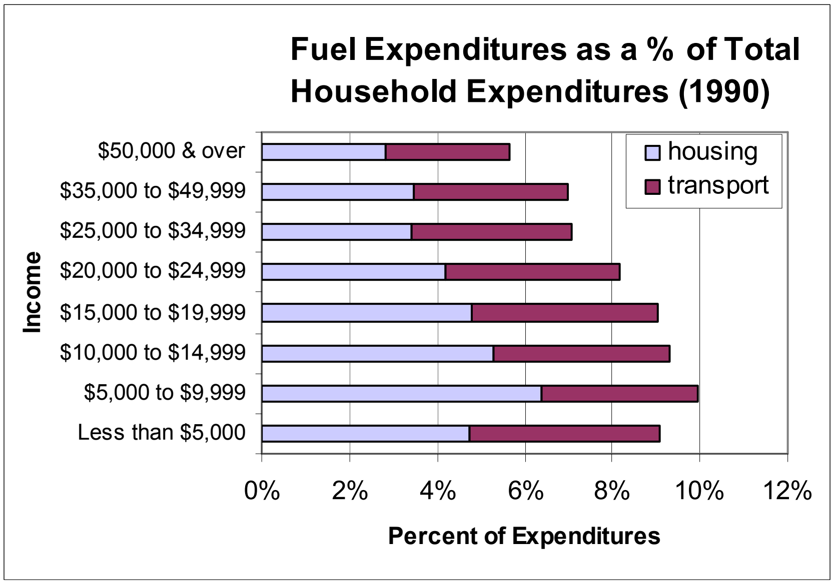
Like most OECD countries, the USA has nearly 100% electrification. Electrification was completed by the mid 1950s through the efforts of the Rural Electrification Administration created by President Roosevelt as part of the New Deal. Energy prices are also lower in the USA than they are in most of the OECD (Fig 5). The burden of energy expenditures for the average household (electricity and fuels) is approximately the same for 1990 and 2004 at 7.4% and 7.5% of total expenditures respectively. Still, the burden of energy expenditures is not even: households with an annual income of $5,000 and $10,000 spent 10.1% on energy in 2004 (Fig 6a+6b BLS, 2005). Total transportation and housing expenses account for over 50% of expenditures in all but the highest income brackets.

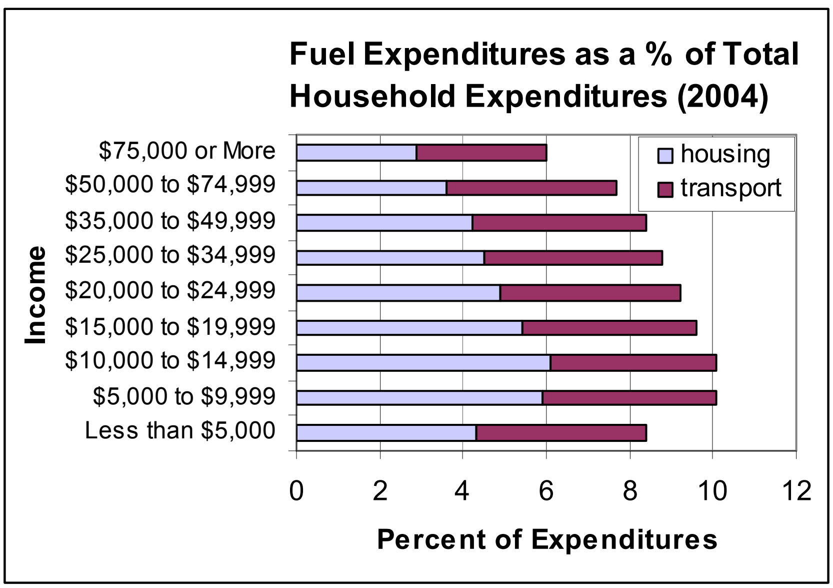
Figure 5: Residential Electricity Prices by Country (EIAb, 2004)



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2001.

Figure 6a and 6b: Fuel Expenditures as a % of Household Expenditures for 1990 and 2004 (BLS, 2005)





Calculation of Indicator 3 vector value (household access to electricity)
Values:

X (1990) = 100% households with access to electricity
X (2004) = 100% households with access to electricity
W (Unsustainable, 1) = 0% households with access to electricity
Y (Sustainable, 0) = 100% households with access to electricity

Vector Value:
I(1990, 2004) = (100% – 100%) / (0%-100%) = 0

Indicator 4: Investment in Clean Energy

Studies cited by HELIO International show that investments in clean energy — renewable energy and energy efficiency — create more jobs and generates faster growth than comparable investment in conventional energy. Because data on new employment by sector is often not available, HELIO uses investment as a proxy indicator. This too is difficult information to find and clarify as it requires compilation of financial information from government and a diffuse set of public and privately held companies.

Total energy-related investments/expenditures should include all public and private investment/expenditures in fossil, nuclear, and renewable energy. These investments include improvements in infrastructure and existing facilities, investment in new capital equipment and facilities, fuel processing, transportation, delivery, and disposal (e.g., spent nuclear fuels), exploration and extraction of fuels, and research and development.

Unfortunately, comprehensive data could not be found, and this indicator is calculated using public sector R&D investment. R&D investment creates some jobs directly but is more an indicator of the possibility that related future investments will contribute to future energy supplies and thus to future job creation. However, the relationship will differ between job creation from R&D spending and from wider investment in technology deployment and production. Public R&D investment may not, however, result in wider investment or correspond to private investment, thus there are many limitations to its use as an indicator. Nonetheless, providing a ratio of renewable to nonrenewable public R&D does give some indication of the relative significance placed on each.

Figure 7, 8 and 9 indicate both that overall R&D is declining in both public and private sectors and that public R&D for fossil and nuclear energy has substantially outweighed renewable R&D. Much of fossil fuel investment overall is private sector financing (WEC, 2001).

Figure 7: Public & Private Energy R&D (Kammen and Nemet, 2005)

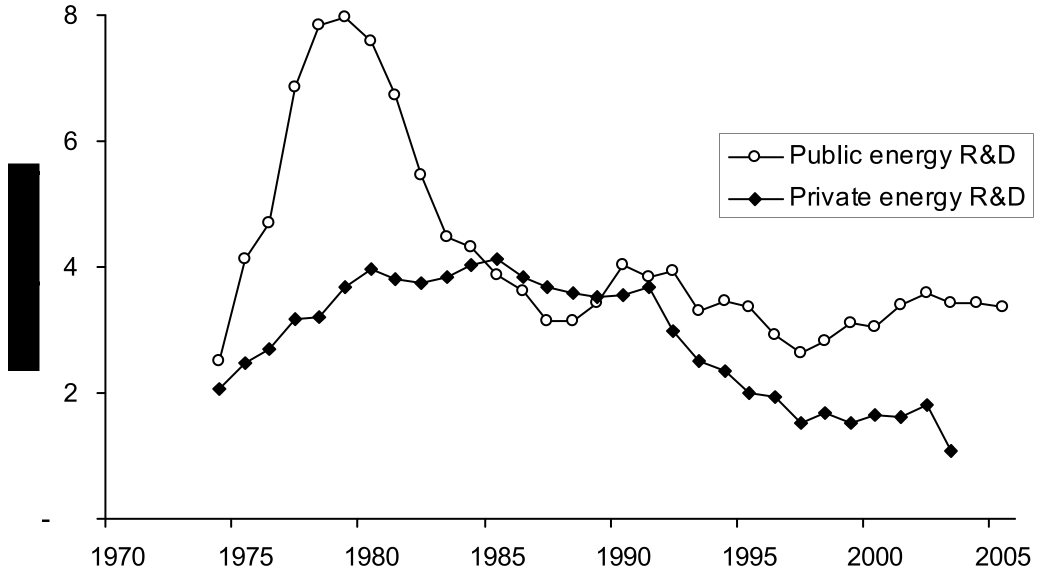


Figure 8: Public R&D for Nuclear and Renewable Energy (Kammen and Nemet, 2005)

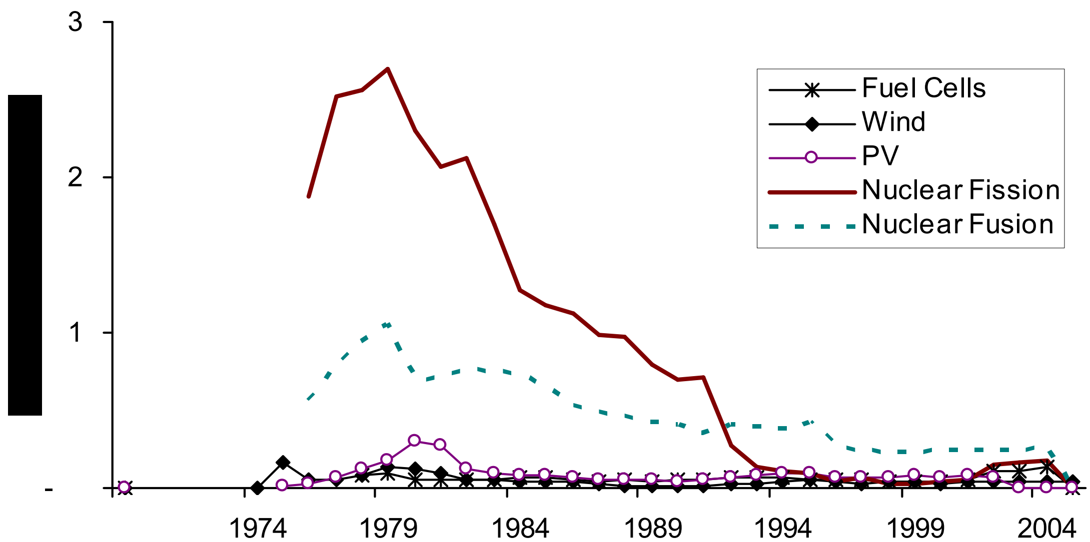
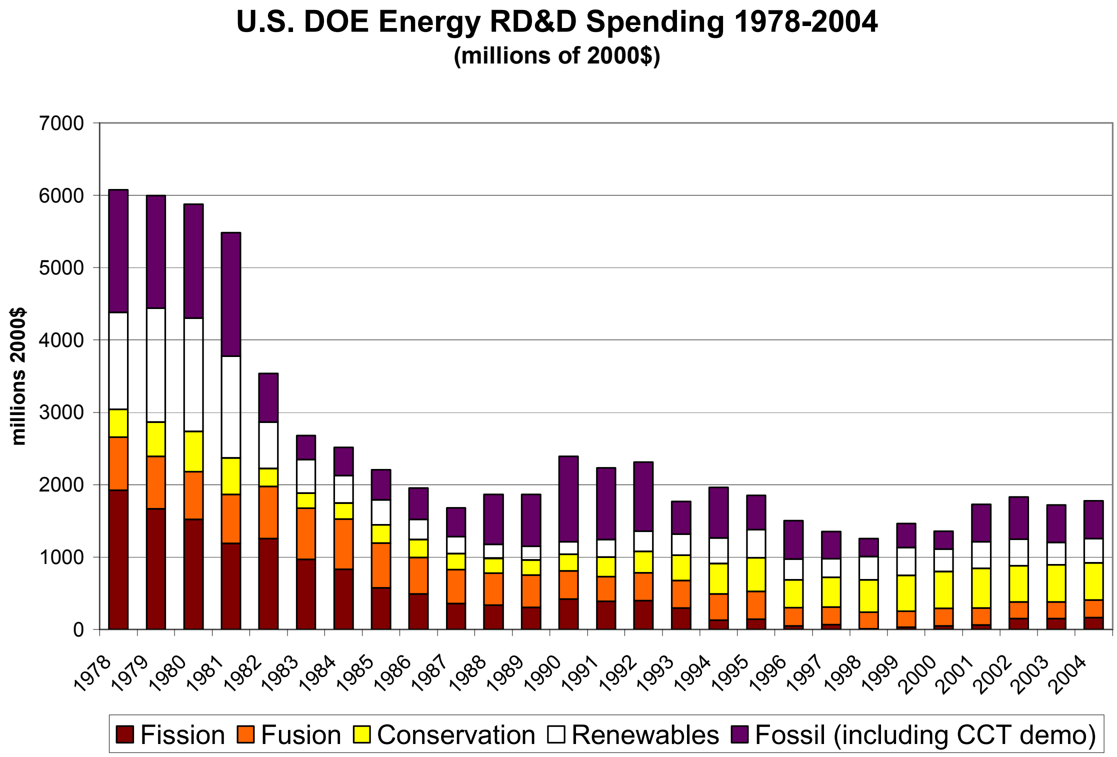


Figure 9: US DOE R&D Spending (Gallagher, 2004)



Given that investment is being used as a proxy for employment, another major factor effecting employment in the energy sector must be mentioned. Deregulation typically results in "improved labor productivity" which translates into job loss and declining wages, unless offset by higher production. According to the International Energy Agency (EIA 1996, p 86), the real value of salaries and wages in the US electricity industry declined 28% from 1986 to 1995 in preparation for de-regulation. Deregulation is also a factor in reduction of R&D investment toward short term investments, and may account for some of the decline in public sector fossil fuel R&D. The IEA suggests that R&D investment in the USA is currently too small in all sectors to ensure a robust energy sector.

In addition to national level public and private investments, there are also significant investments at the state level. Most such investments are funded by system-benefits charges (SBC), and the 15 states that have established clean energy funds are slated to collect nearly $3.5 billion from 1998 to 2012 for renewable energy investments. Simple division (not accounting for discount rates or inflation) puts this at roughly $250 million per year. These provide a widespread palette of innovative programs – mostly focused on development and installation (which creates current jobs and emission reduction) through financing and educational support.

A new report defines support for renewables in terms of "on-budget" or direct support and "off-budget" support such as market-based incentives and renewable portfolio standards. This report states that on-budget support was $1.1 billion in 1999 (including ethanol tax exemptions of $720 million). This tax exemption increased to $1.7 billion in 2005 (REN21, 2005).

Given the variability in investment estimates in general (see indicator #6), and also in calculated R&D estimates specifically, there is significant uncertainty on these numbers.

Calculation of Indicator 4 vector value (% of energy sector investment) Data is DOE R&D spending (Gallagher, 2004). Note that this is not a complete assessment of investment in renewables vs. fossil resources, as noted above. This does indicate that, at least for the DOE, there is some improvement since 1990.

Values:

1990: 233$ billion conservation, 171$ billion renewables, 2391$ billion total DOE R&D

2004: 513$ billion conservation, 333$ billion renewables, 1778$ total DOE R&D

X (1990) = (233$ +171$)/2391$ (billion 2000$) = 16.9%

X (2004) = (513$+333$)/1778$] (billion 2000$) = 47.6%

W (Unsustainable, 1) = the value of X in 1990 = 16.9%

Y (Sustainable, 0) = 95% of energy sector investment

Vector Value:

I(1990) = (16.9% – 95%) / (16.9%-95%) = 1.000

I(2004) = (47.6%– 95%) / (16.9%-95%) = 0.607

Economic Sustainability

Indicator 5: Energy Security/Energy Trade

The HELIO energy security indicator is based on the concept that high dependency on imported fossil fuels leaves a country open to the threat of supply interruption and radical price fluctuations. Possible triggers include pipeline accidents, system vulnerabilities, embargoes, terrorism, civil strife, and other unforeseeable political reasons. Along those lines, the US has suffered from 4+ major price spikes, and there are arguments within and outside of the country that too much of US foreign policy, including the recent Iraq war, is driven by the drive to safeguard reliable and secure access to oil supplies.

US fossil fuel dependence has increased dramatically from 1990. In 2004 the US imported 30.2% of its non-renewable fuel requirements, up from 17.9 % in 1990 (EIA b., 2005 Table 1.4 Energy Imports, Exports, and Net Imports, 1949-2004). This result masks the fact that from 1990 to 2004 US dependence on imported oil has grown from 46% to 62%. Natural gas dependence has also risen sharply -- from 7% to 15% (EIA b.). Much of this oil is still sourced from the Persian Gulf (Figure 10) and there is increasing competition for supply from developing nations.

Figure 10: USA Fossil Fuel Imports (EIA b., 2005)

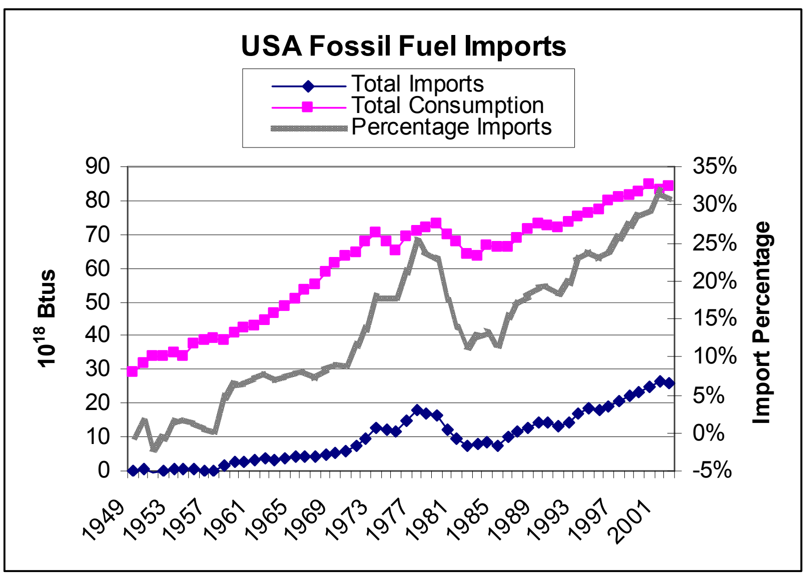
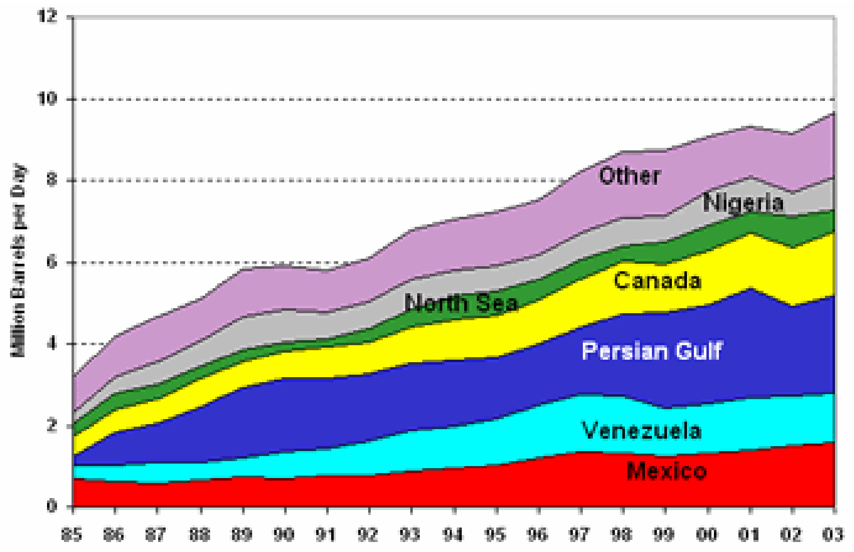


Figure 11: US Crude Oil Imports by Source (EIA a., 2005)



Price hikes and supply disruptions as a result of oil dependence may become an increasing concern: In 2004, with a weather-induced decrease in US production and political instability in Iraq, an increase in OPEC production appeared for the first time unable to moderate crude oil prices in the US. Fossil fuel imports cost $78.2 billion in 1990, $134.1 billion in 2000, $190.5 billion in 2004 (in real 2000$, EIA Annual Energy Review, Table 3.7), and likely to have been far higher in 2005.

Today energy security is a significant concern around the country with widely disparate suggestions for how to deal with the problem (as discussed above in Energy Policy). The majority of USA oil consumption is for transportation (at 65%, with non-fuel uses like plastic next at 13% - See Appendix), thus solutions must be either or all of: (1) reduced consumption in the transportation sector, (2) switch to alternative fuels in the transport sector, (3) increased domestic supply of oil. Other efforts to reduce consumption or facilitate use of renewables can improve USA emissions and other objectives, but will not improve energy security as measured by this indicator.

Calculation of Indicator 5 vector value (ratio between imports of non-renewable energy and the consumption of non-renewable energy) Importing countries can improve sustainability by reducing either imports or consumption of non-renewables or increasing imports or consumption of renewable energy.

Table 7: Fossil and Nuclear Fuel Data (EIAb., 2005 Table 1.3 & 1.4):

	1990	2004
Total Fossil Fuel Consumption (billion BTU)	72459544	85648997
Total Nuclear Energy Consumption (billion BTU)	6104350	8231732
Sum (billion BTU)	78,563,894	93,880,729
Total Fossil Fuel Imports (billion BTU)	14,052,111	28,394,768
Percent imports	17.9%	30.2%

Values:

X (1990) = 17.9 %(EIA b., 2005 Table 1.4)
X (2004) = 30.2 %(EIA b., 2005 Table 1.4)
W (Unsustainable, 1) = 100%
Y (Sustainable, 0) = 0%

Vector Value:
I(1990) = (17.9%– 100%) / (0%-100%) = 0.179
I(2004) = (30.2%– 100%) / (0%-100%) = 0.302

Indicator 6: Burden of Energy Investments

This indicator compares government investment in non-renewable energy supply to total Gross Domestic Product (GDP) as a measure of the burden of energy development on the economy.

Developing a concise result for the USA's burden of energy investment was hindered by the prevalence rather than the lack of prior research. There are a number of conflicting studies on Federal energy investment (or subsidy). Estimates range from approximately $5-$50 billion dollars, depending on what is included as a subsidy (see table 5). At a basic level, investment (or subsidy) considers national (not state level) expenditures for R&D, energy supply, transmission & distribution, and any other subsidies and tax credits that contribute to energy sector development. One of the most contentious assumptions is whether or not the Price Anderson Act, which absolves nuclear facilities from liability, is considered a subsidy.

The two tables below gives a brief overview of study estimates of subsidy intensity during early stage development (table 8) and gross levels of support (table 9). Overall, the investment in renewables is a small fraction of the total energy investment and the total subsidy per $GDP is low (under 1% for non-renewables) in both recent and reference years regardless of the estimate used. Given the overall strength in the US economy, very few sectors in the USA achieve more than 1% of the GDP. Better measures of the burden of nonrenewable energy investment for economies such as the USA might be the ratio of public to private investment, skewness (how public spending favors one form of energy over others), and cost shifting (what are the externalities triggered by public and/or private energy investment). Figures 7-9 in indicator 4 show some of this data.

Table 8: Federal Energy Subsidies: Study Results (Goldberg, 2000)*

Study	Findings – Federal Subsidies (in 1999 dollars)
Richard Heede, Richard E. Morgan, and Scott Ridley, The Hidden Costs of Energy (Washington, DC: Center for Renewable Resources, Oct. 1985)	1984 Estimate: total $67.7 billion. including direct program expenditures, tax expenditures, loans and loan guarantees, bonds. Subsidies: nuclear $23.8 billion; hydro $3.6 billion; oil $13.1 billion; coal $5.2 billion; natural gas $7.1 billion; electricity $9.6 billion;
Douglas Koplow, Federal Energy Subsidies: Energy, Environmental, and Fiscal Impacts, App. B, Vol. I (Washington, DC: The Alliance to Save Energy, 1993)	1989 Estimate: total $28.1–47.7 billion. including direct expenditures, tax credits, liability limitation, regulation, loans, trust funds, and excise taxes. Subsidies: nuclear fission $6.7–14 billion; other nuclear $500 million; hydro $500–800 million; oil $7.2–11.6 billion; coal $7.3–10.6 billion; natural gas $2.8–5.6 billion; renewables $2.0–2.9 billion; efficiency $200 million;
Energy Information Administration, Federal Energy Subsidies: Direct and Indirect Interventions in Energy Markets, SR/EMEU/92-02 (Washington, DC: DOE, 1993)	1992 estimate: total $5.7 billion. including direct program expenditures, tax expenditures, trust funds, excise taxes. Subsidies: nuclear $1.0 billion; oil - $1.8 billion (incl. – $3.6 billion excise taxes collected for specific activities, without offsetting liabilities); coal $1.2 billion; natural gas $1.3 billion; renewables (including hydro) $1.0 billion; efficiency $740 million; electricity $2.1 billion;
Energy Information Administration, Federal Financial Interventions and Subsidies in Energy Markets 1999: Primary Energy, SR/ OIAF/99–03 (Washington, DC: DOE, September 1999)	FY 1999 estimate: total $3.95 billion, including direct program research and development expenditures, tax expenditures, trust funds, excise taxes. This study excludes programs that cover end-use energy and electricity. Subsidies: nuclear $640 million; oil $312 million; coal $489 million; natural gas $1.2 billion; mixed oil, gas, coal $205 million; renewables (including hydro) $1.1 billion; electricity $73 million (for advanced turbine technology, with other generation technology distributed by fuel type);
Pacific Northwest Laboratory, An Analysis of Federal Incentives Used to Stimulate Energy Production, prepared for DOE (Richland, WA: February 1980)	Multiyear (1933–78) cumulative estimate: total $577.3 billion, including direct expenditures, tax credits, loans, bonds, trust funds. Subsidies: nuclear $48.1 billion; hydro $38.7 billion; oil $282.8 billion; coal $26.7 billion; natural gas $33.3 billion; electricity $147.7 billion;

Management Information Services, Federal Incentives for the Energy Industries (Washington, DC: 1998)	Multiyear (1950–97) cumulative estimate: total $586.8 billion, including direct program expenditures, tax expenditures, regulation, grants and loans. Subsidies: nuclear $63.5 billion; oil $283 billion; coal $70.7 billion; natural gas $75.9 billion; renewables (including hydro) $93.6 billion;
Marshall Goldberg (2000) Federal Energy Subsidies: Not all Technologies are Created Equal. Renewable Energy Policy Project	Multiyear (1943-99) cumulative estimate for non-fossil fuel: total $151 billion (excluding hydropower) all direct program budgetary outlays, plus several of the most notable off-budget subsidies and policies, including tax credits and incentive payments for renewable energy, as well as nuclear liability limitations. Nuclear $145.4 billion, photovoltaic and solar thermal power $4.4 billion, wind $1.3 billion.

*Note: Summary table from this document revised to include itself

Table 9: US Federal Subsidies to Energy, a Comparison of Estimates for All Fuels for Various Fiscal Years Source: Koplow, 2006

Study, Publication Date, Sponsor	**Data Year(s)**	**Total Subsidies (Billions of 2004$)**	
		Low	High
Koplow (2004) for the National Commission on Energy Policy (does not include all program types)	2003	37.8	65.4
Energy Information Administration (1999 and 2000) for US DOE	1998-99	6.9	6.9
Management Information Systems (1998) - Average Annual Value	1950-97	13.3	13.3
Koplow (1993) for Alliance to Save Energy	1989	29.3	49.9
Energy Information Administration (1992) for US DOE	1989-92	7.2	7.2
Heede et al (1985) for the Center for Renewable Resources	1984	70.7	70.7
Pacific Northwest Laboratory (1980) for US DOE - Avg annual value	1933-78	11.5	11.5

Calculation of Indicator 6 vector value (ratio between public investment in non-renewable energy and GDP): the GDP values for 1989 and 2003 are for used for 2004$ values. The public investment values are from Koplow 1993 and Koplow 2004, respectively. These are not truly commensurate as they differ in the investments included. Also please note that these numbers do not exclude renewables. From table 8 it appears that renewables are generally a small portion of the total, and thus their exclusion would not change the X values to the extent where it would significantly affect the HELIO indicator. This is because the HELIO 'unsustainable' value is 10% of

GDP, which is far greater than any of the above estimates of energy investment would give. Also due to the variability in estimates, these results are not necessarily accurate.

Values:

X (1989 high) = 40.6 billion$ / 7,621 billion$ GDP= 0.53%
X (1989 low) = 18.1 billion$ / 7,621 billion$ GDP = 0.24%
X (2003 high) = 65.4 billion$ / 11,342 billion $ GDP = 0.58 %
X (2003 low) = 37.8 billion$ / 11,342 billion $ GDP = 0.25 %
W (Unsustainable, 1) = 10%
Y (Sustainable, 0) = 0%

Vector Values:

I(1989) = (0.53%– 0%) / 0.1 = 0.053
I(2003) = (0.58%– 0%) / 0.1 = 0.058

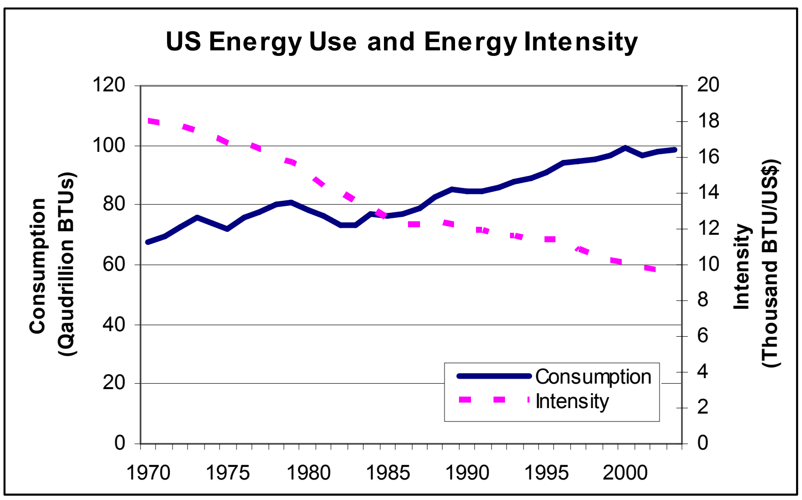
Technological Sustainability

Indicator 7: Energy Productivity

US energy productivity in terms of MJ/$GDP has increased from 1990 to 1994, but less so than in the 70s and early 80s (Figure 11). These productivity gains since the 70s have significantly reduced US energy demand from what they otherwise would have been. While significant efficiency improvements have been realized in all sectors of the US economy, some industrial sector gains may be due more to the outsourcing of energy-intensive industries (such as base metal smelting) to developing nations.

US energy consumption has continued to increase as gains in efficiency are outweighed by increased consumption. While building energy use/ square foot has decreased average square footage of a residence or office has increased. Combustion engine efficiency gains have been similarly eclipsed with Americans driving larger faster cars more miles.

Figure 12: Primary Energy Use and Energy Intensity of the US Economy (EIA, 2005)



Calculation of Indicator 7 vector value (ratio between energy consumption and GDP) real GDP (2004$) was converted to EUROs using the current gold standard of 1 EUR = 1.21073 USD. If X were calculated as MJ/US$, the values would be X(1990) = 11.5, X(2004) = 9.0.

Values:

X (1990) = 9.5 MJ/euro US GDP (EIA, 2004)
X (2004) = 7.4 MJ/euro US GDP (EIA, 2004)

Conversions used: 1 BTU = 0.0010551MJ
1 EUR = 1.21073 USD (current gold standard)

W (Unsustainable, 1)= 10.64 MJ/euros which corresponds to the average world consumption of primary energy per unit of GDP in 1990
Y (Sustainable, 0) = 1.06 MJ/euros which corresponds to 1/10 W
Z = W-Y = 9.58

Data: EIA, 2005 Table 1.3 Energy Consumption by Source, 1949-2004

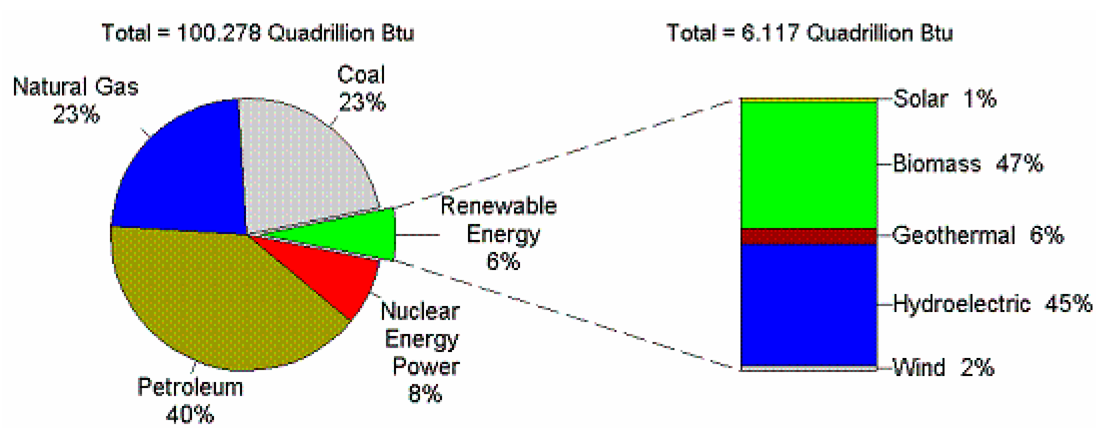
Vector Value

I(1990) = (9.5 – 1.06)/ 9.58 = 0.881
I(2004) = (7.4–1.06)/ 9.58 = 0.911= 0.662

Indicator 8: Renewable Energy Deployment

Renewable energy consumption totaled 6.1 quadrillion Btu in 2004, providing approximately 6 % market share of total US energy consumption (Figure 12). While renewable energy use has increased since 1990, the growth in total energy consumption has outpaced growth in renewable energy (Figure 13), causing the percent provided by renewables to decline from 7.2% in 1990.

Figure 13: The Role of Renewable Energy Consumption in the Nation's Energy Supply, 2004 (EIA, 2004)



High capital costs are cited by EIA as a major factor hindering development of new renewable energy facilities, along with little development of new hydro sites and declining use of biomass for non-electric purposes. There has been a recent large increase in renewables use in the transport sector from use of ethanol in place of MTBE as an oxygenate in approximately 30% of the gasoline sold in the USA. Ethanol use amounts to about 3% of non-diesel fuel consumption. (REN21, 2005) The USA follows Brazil as the world's second-largest consumer and producer of fuel ethanol, and has increased production from 4 billion liters/yr in 1996 to 14 billion liters/yr in 2004, with over 80 ethanol production plants and approximately 400 fueling stations selling E85, an 85:15 ethanol: gasoline blend.

Approximately 45% of renewable production is hydropower, with four states providing 61% of hydro output (Washington, California, Oregon, New York). Variations in hydropower and biomass supply dwarf growth in other renewables (Figure 14b). Wind energy is the fastest growing renewable energy supply (Figure 14c) despite the fact that many wind projects have been stalled or stopped by so called "not-in-my-back-yard" (NIMBY) responses. What was to be the first US offshore wind park of (450MW peak capacity & 130 turbines) off of Cape Cod has stalled due to opposition by residents.

Figure 14a: Total USA Energy Consumption (EIA, 2005)

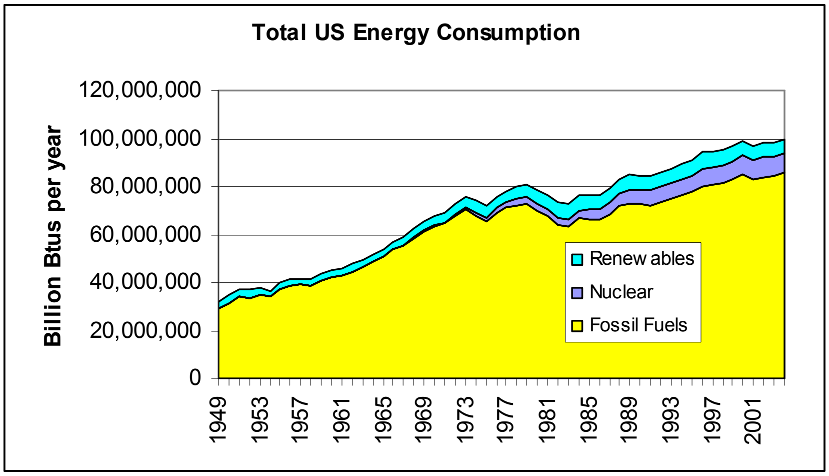


Figure 14b: USA Renewable Energy Consumption (EIA, 2005)

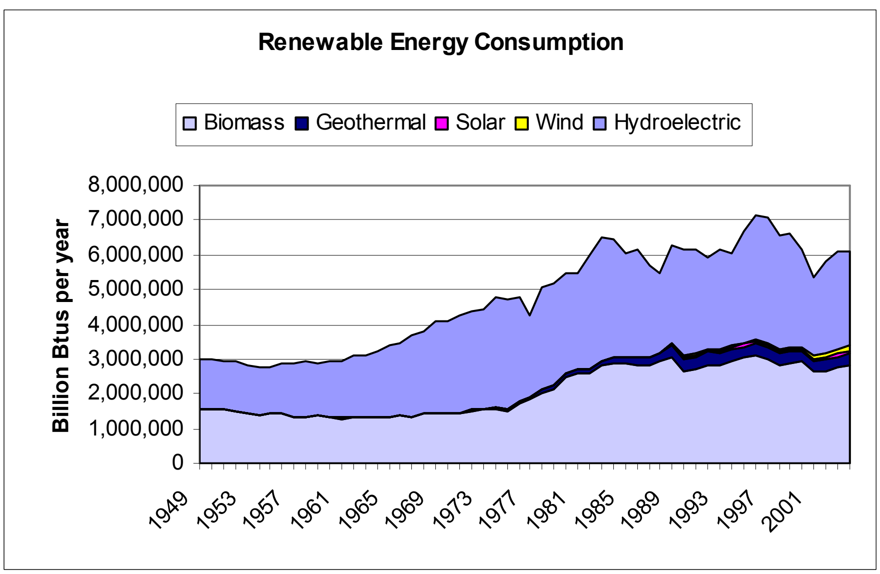
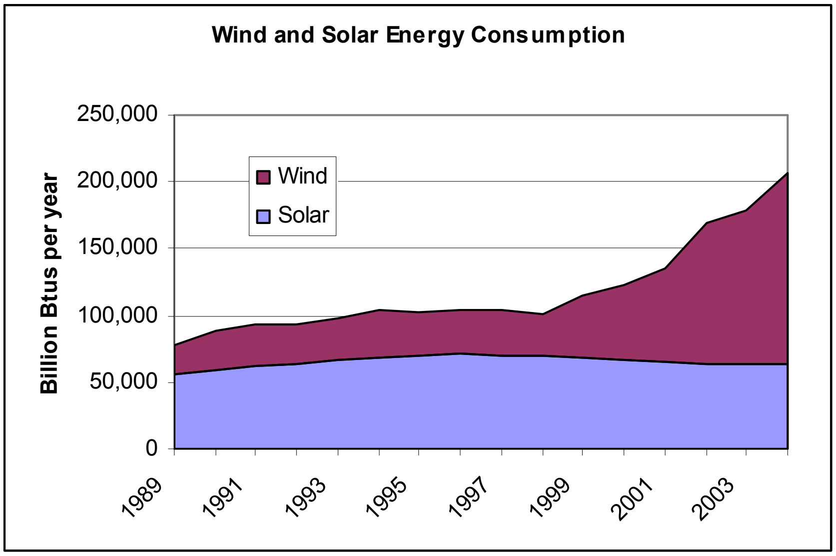
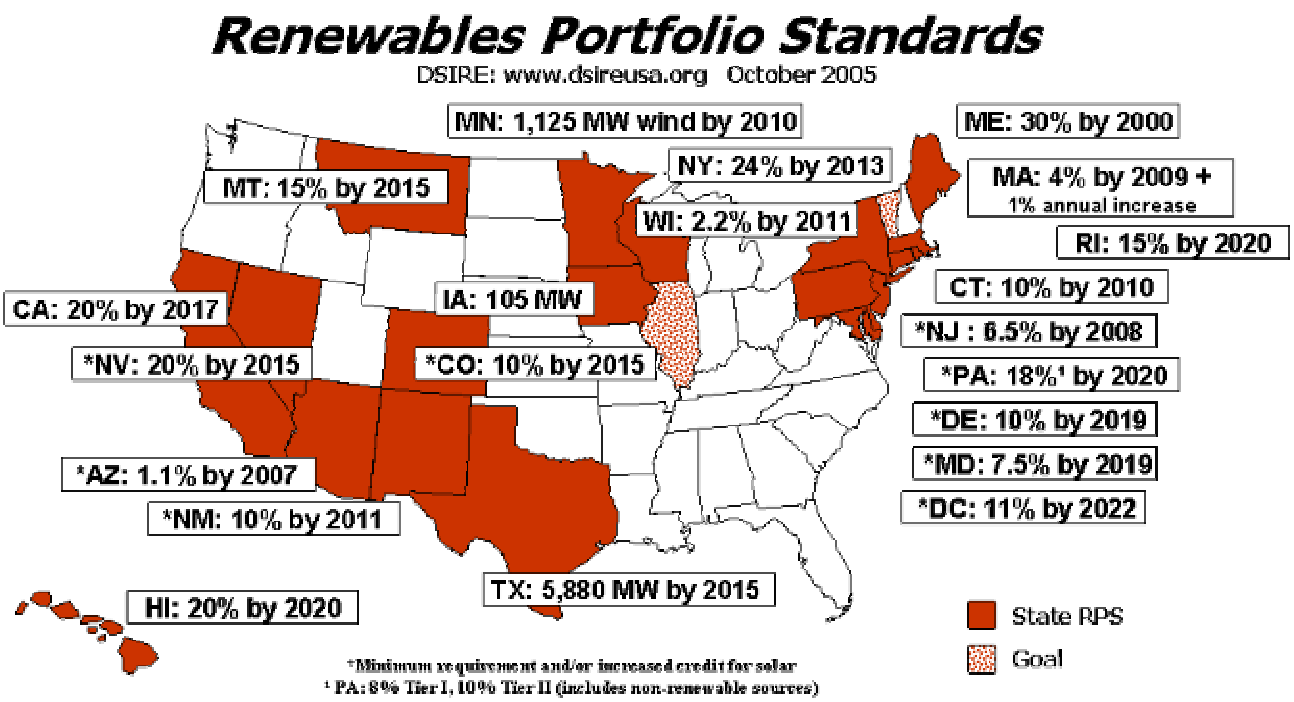


Figure 14c: USA Solar and Wind Energy Consumption (EIA, 2005)



There has not been a national focus on renewable energy deployment and the numbers show it. At the same time, there are many state level initiatives and support (shown in the appendix), which have significantly increased the demand for renewable energy supplies, particularly electricity. For example, 20 states have adopted (and others are considering) renewables portfolio standards (RPS) requiring a certain percent of renewables in the energy supply (Figure 15).

Figure 15: State Renewable Portfolio Standards (DSIRE, 2005)



Some utilities have begun to offer “green power”, charging a premium that is now typically 1-3 c/kWh (REN21, 2005). Green power consumers include approximately ½ million individual (4,500 GWh/yr), and also many large companies (the EPA’s “Green Power Partnership” had 600 members demanding 2,800 GWh/yr) and city, state, and national governments (REN21, 2005).

Calculation of Indicator 8 vector value (ratio between renewable energy consumption and total primary energy consumption)

Values:

X (1990)	=	7.2% of Total Energy Consumption (EIA, 2005)
X (2004)	=	6.1% of Total Energy Consumption (EIA, 2005)
W (Unsustainable, 1)	=	8.64%
Y (Sustainable, 0)	=	95%
Z = W-Y	=	-86.36%

Data Source: Table 1.3 Energy Consumption by Source, 1949-2004 (EIA, 2005)

Vector Value:
I(1990) = (7.2%– 95%)/ -86.36% = 1.017
I(2004) = (6.1%–95%)/ -86.36% = 1.029

Presentation of the US's SEW Star

The Star graphically illustrates the indicator results, with the orange (light) line indicating the values for 1990 and the blue (heavy) line indicating values for the most recent year that data was available (2002-2004 for different indicators). Most indicator values fall between zero and one, with zero indicating good sustainability performance and one indicating poor performance according to HELIO International standards. However, indicator #1, per capita carbon emissions, is at approximately 6.5, indicating very poor performance according to HELIO International standards.

Table 10: Sustainable Development Indicators for the Energy Star

Description of Indicator Name	Unit	Current Year	Data Points		Star values	
			X(current)	**X(1990)**	**I(current)**	**I(1990)**
1) CO2 emissions	kgC/cap	2003	5,442	5,468	6.460	6.383
2) Ambient pollutants	thousand short tons	2002	n/a	n/a	0.680	1.000
3) Access to electricity	%	2004	100.0	100.0	0.000	0.000
4) Investments	%	1999	6.3	6.9	0.607	1.000
5) Vulnerability	%	2004	30.4	17.9	0.302	0.179
6) Public sector investment	%	1992,99	0.04	0.06	0.058	0.053
7) Energy productivity	MJ/$	2004	8.1	10.4	0.662	0.881
8) Renewable energy	%	2004	6.1	7.2	1.029	1.016

Figure 16a: HELIO Energy Star (Scale of 0-2)

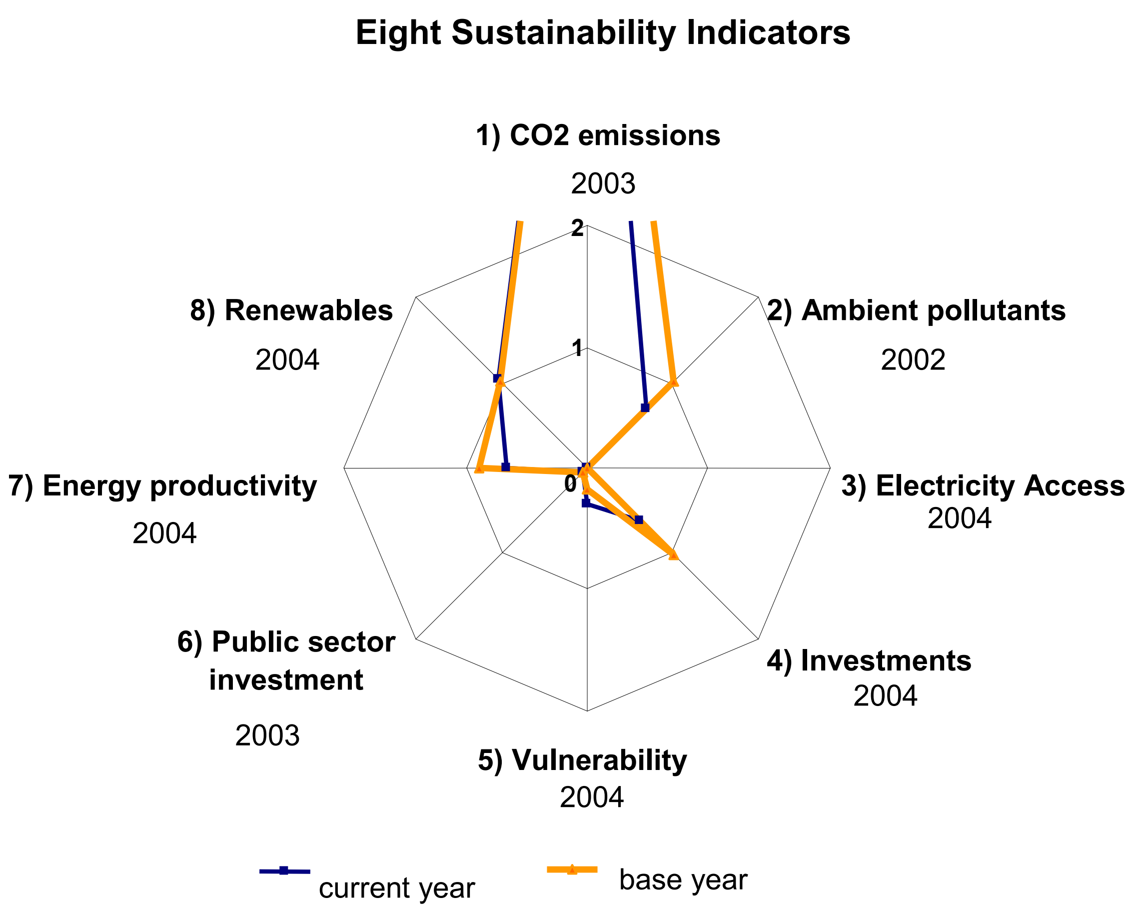
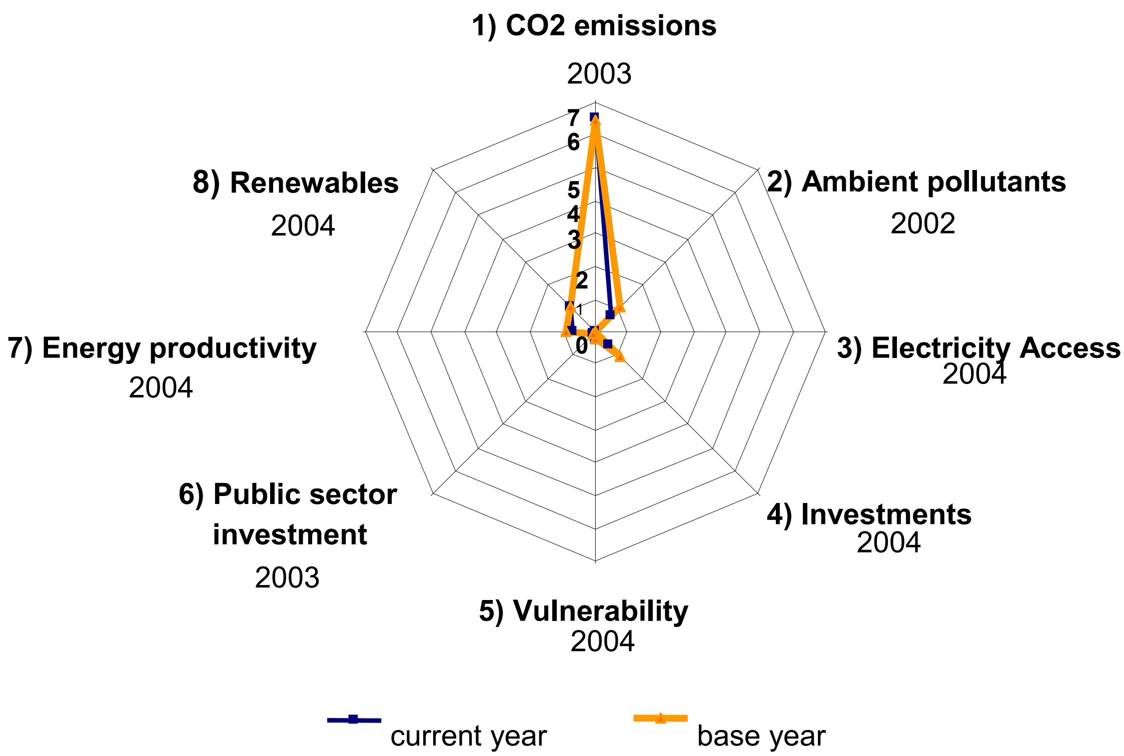


Figure 16b: HELIO Energy Star (Scale of 0-7)



Conclusions

The US energy system is presently far from sustainable. While the US is on par with the developed world for some of the indicators (100% electrification, high energy productivity), the US is, for most indicators, increasingly unsustainable. The USA's energy use, energy-related emissions, and dependence on foreign energy supply have all worsened.

The US as a nation has not yet united around an energy strategy. Nonetheless, US citizens are becoming more aware of the problem of energy dependence and citizen groups, alliances, and governments are all making efforts to rectify the situation. State level actions should be encouraged and expanded - from renewables portfolios to taxation and other ways of taking into account the full environmental and social cost of energy use. Consortiums of states to develop carbon trading systems can be trialed along with community and state efforts to meet the Kyoto protocol. Increasing the awareness of energy issues in the American public is a constant and vital action. Efforts to frame energy policy objectives in terms of security, jobs, and technological leadership have had some success and are important to the continued education of the American public about these issues.

While all of these initiatives should be encouraged, there remains a need for a unified national effort. The growth in state initiatives suggests the potential for national level support of an Apollo scale effort to reduce dependence on foreign oil including a focus on efficiency and development of renewables. The potential benefits of such an effort are numerous and varied: a stronger economy, better air quality, more jobs, lowered emissions, a more robust energy system, decreased contribution to climate change and future impacts of global warming, renewed technological leadership, green export markets, renewed participation in global agreements, and enhanced energy security at home and abroad.

In Bush's State of the Union Address on January 31, 2006, he stated that "Americans are addicted to oil." On this, few disagree. What to do about it is another story. Whether the US can resolve its differences and unite around a comprehensive energy strategy remains to be seen.

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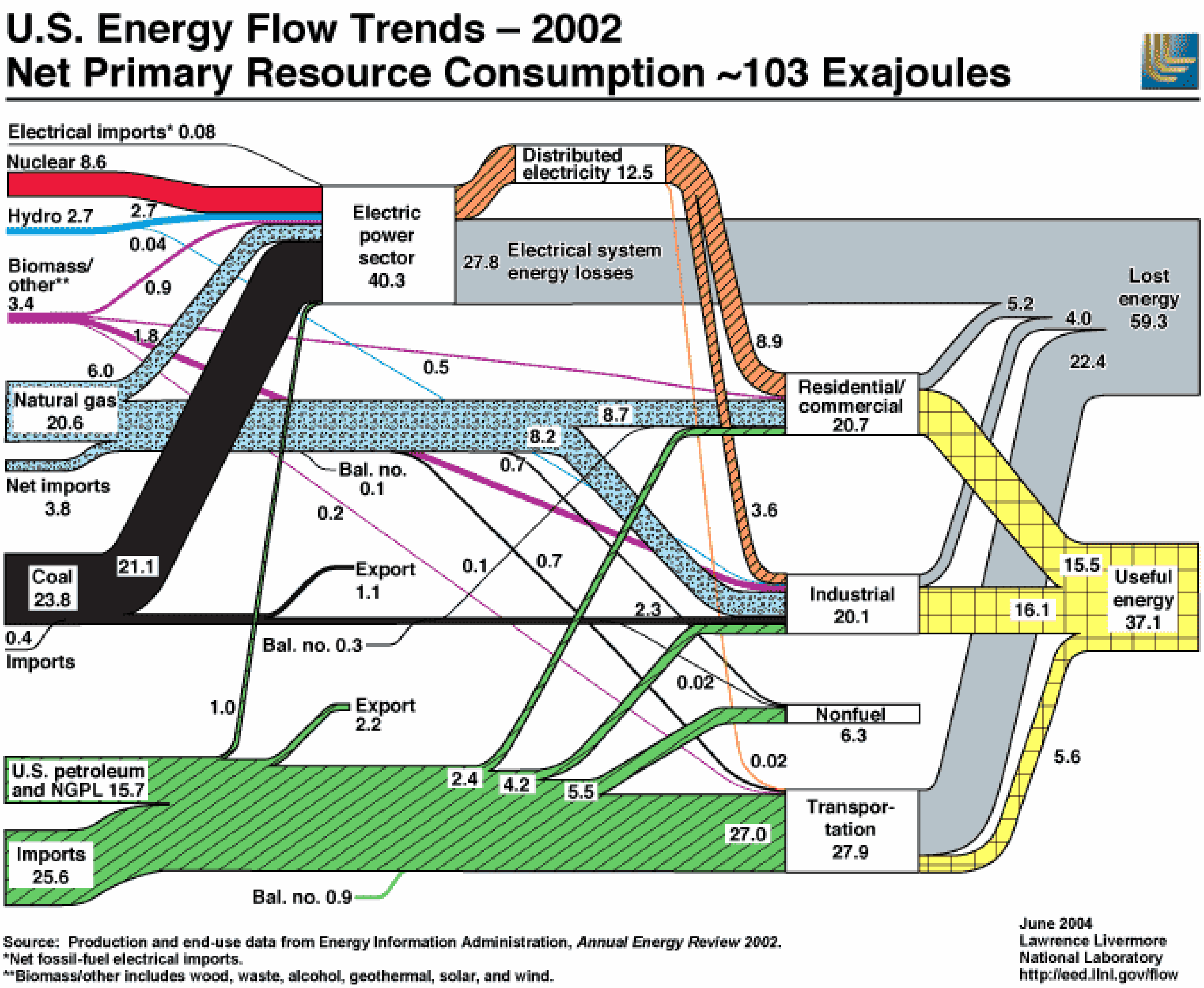
Appendix

USA Energy Flow Schematic
(http://eed.llnl.gov/flow/02flow.php)



Database of State Incentives for Renewable Energy – Financial Incentives

(http://www.dsireusa.org/)

State/Territory	Personal Tax	Corporate Tax	Sales Tax	Property Tax	Rebates	Grants	Loans	Industry Recruit.	Leasing/ Sales	Production Incentive*
Federal	2	4				2	2			1
Alabama	1-S					1-S				
Alaska							1-S			
Arizona	2-S		1-S		4-U					
Arkansas										
California	2-S	1-S		1-S	2-S, 15-U, 2-L	1-L	1-U		1-U	1-S
Colorado					1-S, 1-U, 1-L		1-U, 1-L			2-L
Connecticut				1-S	1-S	3-S	3-S			
Delaware					1-S	2-S				
Florida			1-S		2-U					
Georgia										1-U
Hawaii	1-S	1-S			2-U		1-U, 2-L	1-S		
Idaho	1-S		1-S			2-P	1-S			
Illinois				1-S	1-S	1-S, 1-P				
Indiana				1-S		4-S				
Iowa	1-S	1-S	1-S	3-S		1-S	2-S			
Kansas				1-S		1-S				
Kentucky							1-P			1-U
Louisiana				1-S						
Maine					1-S	1-S				
Maryland	1-S	1-S	1-S	2-S	1-S, 1-L		2-S			
Massachusetts	2-S	3-S	1-S	1-S	1-S	2-S				1-S, 1-P
Michigan				1-S	1-S	4-S	1-S	3-S		
Minnesota			2-S	1-S	1-S, 1-U	1-U	3-S			1-S
Mississippi							1-S			1-U
Missouri		1-S				1-S	1-S			
Montana	2-S	2-S		2-S		2-P, 1-U	1-S			
Nebraska							1-S			
Nevada			1-S	3-S	1-S					1-S
New Hampshire				1-S						
New Jersey			1-S		1-S	2-S	1-S			1-S
New Mexico		1-S	1-S			2-S				
New York	1-S		1-S	1-S	3-S, 1-U	1-S	1-S			
North Carolina	1-S	1-S		1-S			1-S	1-S		1-U, 1-P
North Dakota	1-S	1-S	1-S	2-S						
Ohio		1-S	1-S	1-S		1-S	1-S			
Oklahoma		1-S						1-S		
Oregon	1-S	1-S		1-S	2-S , 6-U	2-P, 1-S	1-S, 4-U			1-P
Pennsylvania					1-L	1-S, 5-L	5-L			1-U
Rhode Island	1-S		1-S	1-S	2-S	1-S				1-S, 1-P
South Carolina					1-S					
South Dakota				2-S						
Tennessee				1-S			1-S			1-U
Texas		1-S		1-S	2-U			1-S	1-U	
Utah	1-S	1-S	1-S							
Vermont			1-S		1-S	1-U				1-U
Virginia				1-S		1-S		1-S		
Washington			1-S		6-U	2-P	5-U	1-S		2-U, 1-P, 1-S
West Virginia		1-S		1-S						
Wisconsin				1-S	1-S, 2-U, 1-P	1-S	1-S, 1-U			
Wyoming			1-S		1-S				1-U	

State/Territory	Personal Tax	Corporate Tax	Sales Tax	Property Tax	Rebates	Grants	Loans	Industry Recruit.	Leasing/ Sales	Production Incentive*
District of Columbia						1-S				
Palau										
Guam										
Puerto Rico	1-S		1-S							
Virgin Islands										
N. Mariana Islands										
American Samoa										
Totals	22	23	20	34	72	53	48	9	3	24

S= State
U = Utility
L= Local
P = Non-profits

Database of State Rules, Regulations & Policies

Note: This table does not include incentives for renewable fuels and vehicles. For these incentives, go to
http://www.eere.energy.gov/afdc/laws/incen_laws.html

State/ Territory	PBF	Disclosure	RPS	Net Metering	Inter-connection	Extension Analysis	Contractor License	Equipment Certification	Access Laws	Construction & Design Standards	Green Power Purchase	Required Green Power
Alabama												
Alaska									1-S			
Arizona		1-S	1-S	2-U	1-U	1-S	1-S	1-S	1-S	2-S, 2-L	1-L	
Arkansas				1-S	1-S			1-S				
California	1-S	1-S	1-S	1-S	1-S		1-S		2-S, 8-L	1-S, 9-L	5-L	
Colorado		1-S	1-S, 1-L	1-S, 5-U	2-U	1-S	1-L		1-S, 2-L	3-L	2-L	
Connecticut	1-S	1-S	1-S	1-S	1-S		1-S				1-S	
Delaware	1-S	1-S	1-S	1-S	1-S						1-U	
Florida		1-S	1-U	2-U	1-S		1-S	1-S	1-S, 1-L	1-S		
Georgia				1-S	1-S				1-S			
Hawaii			1-S	1-S	1-S		1-S		1-S	1-S		
Idaho				3-U	2-U				1-S			
Illinois	1-S	1-S	1-S	1-U	1-U					1-L	1-S, 1-L	
Indiana				1-S	1-S				1-S			
Iowa		1-S	1-S	1-S	1-S				1-S		1-S	1-S
Kansas					1-S				1-S			
Kentucky				1-S	1-U				1-S			
Louisiana				1-S	1-S			1-S				
Maine	1-S	1-S	1-S	1-S				1-S	1-S		1-S	
Maryland		1-S	1-S	1-S	1-S				1-S	1-S	1-S, 2-L	
Massachusetts	1-S	1-S	1-S	1-S	1-S				1-S		1-L	
Michigan		1-S		1-S	1-S		1-S					
Minnesota	1-S	1-S	2-S	1-S	1-S			1-S	1-S	1-S		1-S
Mississippi												
Missouri			1-L		1-S				1-S			
Montana	1-S	1-S	1-S	1-S, 1-U	1-S				1-S			1-S
Nebraska									1-S			
Nevada		1-S	1-S	1-S	1-S		1-S		1-S	2-S		
New Hamp.				1-S	1-S				1-S			
New Jersey	1-S	1-S	1-S	1-S	1-S				1-S		1-S	
New Mexico			1-S	1-S	1-S	1-S			1-S			1-S
New York	1-S	1-S	1-S	1-S	1-S				1-S		1-S, 1-L	
N. Carolina					1-S				1-L	1-L		
North Dakota				1-S					1-S			
Ohio	1-S	1-S		1-S, 1-U	1-S				1-S		1-L	
Oklahoma				1-S								
Oregon	1-S	1-S		1-S, 1-L	1-S				1-S, 2-L	2-L	1-L	
Pennsylvania	1-S	1-S	1-S	1-S	1-S						1-S	
Rhode Island	1-S		1-S	1-U	1-S				1-S		1-S	
S. Carolina											3-L	
South Dakota												
Tennessee									1-S			
Texas		1-S	1-S, 1-L	1-S, 2-U	1-S	1-S				1-S		
Utah				1-S	1-S		1-S		1-S		1-L	
Vermont		1-S	1-S	1-S	1-S							
Virginia		1-S		1-S	1-S				1-S, 1-L			
Washington		1-S		1-S, 1-U	1-S				1-S	1-L	2-L	1-S
West Virginia												
Wisconsin	1-S		1-S	1-S	1-S		1-L	1-L	1-S, 1-L	1-L	1-L	

State/ Territory	PBF	Disclosure	RPS	Net Metering	Inter-connection	Extension Analysis	Contractor License	Equipment Certification	Access Laws	Construction & Design Standards	Green Power Purchase	Required Green Power
Wyoming				1-S	1-S							
D.C	1-S	1-S	1-S	1-S	1-S							
Palau												
Guam										1-S		
Puerto Rico								1-S				
Virgin Is.												
N. Mariana Is.												
Amer. Samoa												
Totals	**16**	**25**	**28**	**55**	**42**	**4**	**10**	**8**	**50**	**31**	**32**	**5**

S= State
U = Utility
L= Local
P = Non-profits